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Research

Prescribed exercise programs may not be effective in reducing impairments and improving activity during upper limb fracture rehabilitation: a systematic review

Andrea M Bruder [a], Nora Shields [a,b], Karen J Dodd [a,c], Nicholas F Taylor [a,d]

[a] School of Allied Health, La Trobe University; [b] Department of Allied Health, Northern Health; [c] Victoria University; [d] Allied Health Clinical Research Office, Eastern Health, Melbourne, Australia

KEY WORDS

Exercise
Upper limb
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Systematic review

ABSTRACT

Question: What is the effect of exercise on increasing participation and activity levels and reducing impairment in the rehabilitation of people with upper limb fractures? **Design**: Systematic review of controlled trials. **Participants**: Adults following an upper limb fracture. **Intervention**: Any exercise therapy program, including trials where exercise was delivered to both groups provided that the groups received different amounts of exercise. **Outcome measures**: Impairments of body structure and function, activity limitations and participation restrictions. **Results**: Twenty-two trials were identified that evaluated 1299 participants with an upper limb fracture. There was insufficient evidence from 13 trials to support or refute the effectiveness of home exercise therapy compared with therapist-supervised exercise or therapy that included exercise following distal radius or proximal humeral fractures. There was insufficient evidence from three trials to support or refute the effectiveness of exercise therapy compared with advice/no exercise intervention following distal radius fracture. There was moderate evidence from five trials (one examining distal radius fracture, one radial head fracture, and three proximal humeral fracture) to support commencing exercise early and reducing immobilisation in improving activity during upper limb rehabilitation compared with delayed exercise and mobilisation. There was preliminary evidence from one trial that exercise to the non-injured arm during immobilisation might lead to short-term benefits on increasing grip strength and range of movement following distal radius fracture. Less than 40% of included trials reported adequate exercise program descriptions to allow replication according to the TIDieR checklist. **Conclusion**: There is emerging evidence that current prescribed exercise regimens may not be effective in reducing impairments and improving activity following an upper limb fracture. Starting exercise early combined with a shorter immobilisation period is more effective than starting exercise after a longer immobilisation period. **Registration**: CRD42016041818. **[Bruder AM, Shields N, Dodd KJ, Taylor NF (2017) Prescribed exercise programs may not be effective in reducing impairments and improving activity during upper limb fracture rehabilitation: a systematic review. *Journal of Physiotherapy* XX: XX–XX]**

Introduction

Upper limb fractures are common, and predicted to increase with an ageing population.[1–3] Young adults typically sustain these fractures from high-energy traumas such as motor vehicle accidents, while older adults with osteoporotic changes sustain them from low-energy incidents such as a fall.[4,5] Anyone who sustains an upper limb fracture will experience a period where they have difficulty participating in personal, occupational and sporting activities[6] that may extend to 12 months beyond the time of fracture.[7,8] Some difficulties may be associated with problems related to type or severity of fracture, or to complications such as complex regional pain syndrome. However, some issues may be related to the length and position of immobilisation, surgical treatment or patient-related factors such as age, gender and fear-avoidance behaviour.[1,4,8–11] To address these problems and assist recovery, people are often referred for physiotherapy.[12]

Fracture management is centred on three principles: to reduce, to hold and to move.[13] To address the move principle, therapists often prescribe exercise following upper limb fracture to help people return to pre-injury function.[1,4,10,14,15] Exercise is structured physical activity that is performed with a goal, such as improvement in muscle strength and joint range of movement. Our previous version of this systematic review found preliminary and indirect evidence that conservatively managed distal radius and proximal humeral fractures may benefit from exercise, which is consistent with the theoretical benefits associated with movement.[16] It was difficult to derive a definitive conclusion from that review because exercise was often received by both experimental and control groups, and in conjunction with other therapeutic interventions. The exercise programs were poorly described, preventing inferences about whether one type of program could be more effective in upper limb fracture rehabilitation. Two recently updated systematic reviews investigated treatment and rehabilitation after distal radius[5] or proximal humeral fracture.[4]

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These reviews concluded that there was insufficient evidence to recommend interventions during rehabilitation. It was recommended that advice and general instruction on mobilisation should be provided to all people following a distal radius fracture.[5] Routine advice, education and exercise have also been recommended in proximal humeral rehabilitation.[1]

Given the uncertainty about the role of exercise in upper limb fracture rehabilitation, it is important that the original review,[16] which had a search completed in 2011, is updated so that therapists have current evidence to inform decision-making. The importance of this review is further indicated by the predicted rise in upper limb fractures and subsequent demand on health services for cost-effective management and rehabilitation.[4,7,10,17] New trials evaluating exercise have been published since 2011, and a Template for Intervention Description and Replication (TIDieR)[18] was published in 2014, which was expected to improve reporting of exercise programs in those subsequent trials. Improved reporting provides an opportunity to synthesise available research and better inform therapists about the types of exercise that should be prescribed following upper limb fracture.

Therefore, the research question for this systematic review update was:

> What is the effect of exercise on increasing participation and activity levels and reducing impairment in the rehabilitation of people with upper limb fractures?

Method

This updated systematic review was based on the protocol previously described.[16] To identify new trials, the same search strategy was used (see Appendix 1 on the eAddenda for full search strategy), but was limited between January 2011 and July 2016 in the following databases: CINAHL, MEDLINE, Embase, AMED, SPORT Discus, PubMed, PEDro and the Cochrane Central Register of Controlled Trials. Citation tracking of the included studies was also performed using manual reference list checks and Web of Science. Two reviewers independently examined study titles and abstracts to determine if they satisfied the eligibility criteria (Box 1). Where eligibility was not clear, the full text was obtained.

The data extracted from eligible trials were: trial design; age, gender and diagnosis of the participants; type and description of the exercise intervention; outcome measures; and summary data. Data were extracted by one reviewer using the form from the original review, and checked by a second reviewer. Where means and standard deviations of outcomes were not reported, data were estimated according to recommendations (see Appendix 2 on the eAddenda for statistical equations).[19] Methodological quality of included trials was assessed independently by two reviewers using the PEDro scale.[20] The completeness of intervention description for both intervention and control groups was assessed using the TIDieR checklist by two reviewers working independently.[18] To ensure that each item was accurately assessed, sub-categories for items 3, 6 and 8 were used, which was similar to previous research.[21] Cohen's kappa was calculated to assess the extent of agreement between reviewers for the PEDro scale and TIDieR checklist, where a kappa value ≥ 0.75 was deemed an excellent level of agreement.[22]

Box 1. Inclusion criteria.

Design
- randomised or quasi-randomised controlled trial
- full-text publication

Participants
- humans
- reached skeletal maturity
- sustained any degree of upper limb fracture (scapula, clavicle, humerus, radius, ulna, carpal, phalanx)

Intervention
- any exercise therapy program

Outcome measures
- any outcome measure (classified by WHO 2001)

Comparisons
- exercise therapy program versus no exercise therapy program/placebo
- exercise therapy program plus other therapy versus other therapy
- exercise therapy program versus an alternative therapy program
- programs that compare different amounts of exercise (duration, frequency, intensity) or programs that compare different methods of administering exercise programs

Box 2. Grading system used to describe the level of evidence reported in each trial.

- ++ The trial reported strong or clear evidence that exercise therapy was effective.
- \+ The trial reported moderate or limited evidence that exercise therapy was effective; or there were indications to support the effectiveness of exercise therapy.
- 0 The trial reported insufficient or no evidence to support or refute the effectiveness of exercise therapy; or exercise therapy was equally as effective as an alternative exercise therapy program that may have used different amounts of exercise (duration, frequency or intensity) or different method of administration.
- – The trial reported that exercise therapy was harmful or less effective than no exercise, other therapy, or alternative exercise program.

Meta-analysis was conducted where at least two trials were considered clinically homogenous. Pooled analyses with random effects models to calculate standardised mean differences (SMD) and 95% confidence intervals were applied using Review Manager Version 5.3. Statistical heterogeneity was examined by the I^2 statistic where a value of 0% indicated no observed heterogeneity, <25% was considered low heterogeneity and 100% indicated a completely heterogeneous sample.[23] The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was used to assess the risk of bias between trials for each completed meta-analysis.[24] A randomised, controlled trial was considered the highest level of evidence; however, this rating was downgraded if: PEDro scores were <6 for the majority of trials; there was greater than low levels of statistical heterogeneity between trials ($I^2 > 25\%$); there were large confidence intervals (ie, >0.8 SMD); and there was evidence of publication bias, as demonstrated by asymmetry of a funnel plot if >10 trials were included in the meta-analysis.[25]

In addition, a descriptive synthesis was completed, based on conclusions reported by each trial under the following headings: direct evidence of exercise therapy; indirect evidence of early exercise and early mobilisation; indirect evidence of comparison of different types of exercise therapy programs; and other. A grading system was used to describe the level of evidence reported in each trial,[26] as shown in Box 2.

Results

Flow of studies through the review

The update identified a further 885 possible articles. Following removal of duplicates, screening of titles and abstracts, and citation tracking, 16 potentially relevant articles remained. After re-application of inclusion criteria to full-text versions of the articles, nine were included[27–35] and seven excluded.[36–42] When added to the trials in the original review, 23 articles[27–35,43–56] were included; these comprised 22 separate trials[27–35,43–45,47–56] because one article[46] reported follow-up data (Figure 1).

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